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ABSTRACT

Four interference factors to math learning are poor or no instruction, low motivation, inappropriate learning theory, and physiological learning dysfunction. The math clinic, a teaching-learning strategy, uses diagnostic teaching skills and various learning rates for math studies. Instruction is matched to the student from information provided by diagnostic tests, learning behavior knowledge, and sensory population data. Lessons may be assigned by the teacher, using material from one or a combination of learning systems, i.e., an individualized laminated system, computer-video screen instruction, teacher-centered lecture, discovery lessons, small peer taught lessons, and individual reading and research. A typical university instructional model in mathematics includes large lecture classes, non-English-speaking teaching assistants, self-taught American Indian students, and tutored problem study labs. Students find math resource centers crowded, impersonal, staffed by foreign nationals graduate students, and unable to go beyond review of a particular problem solving strategy. The university mathematics study model uses a survey and diagnostic placement test in conjunction with the ACT-SAT math scores for math class or clinic placement and individualized instructional systems (i.e., video tape lectures, computer assigned instruction, math text and reference library, games, films, diagnostic teacher-tutors). Students enrolled prepare a math course or complete a math course for credit. (NQA)

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A Mathematics Clinic For University Students

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A MATHEMATICS CLINIC FOR UNIVERSITY STUDENTS

All people are capable of learning mathematics. Mathematicians are made, created through learning, not born in the heavens. It is a question of degree of achievement each one of us struggles to answer. Some of us bear great handicaps in our battle to know math. Others soar to intuitive mathematical marvels and a new vision of the universe we live in.

The first question we must ask is: How do we, personally, achieve our highest level of mathematical knowledge?

Mathematics is learned today in classrooms of few to several hundred students: Listening to a lecturer who writes on chalkboards with one hand and erases at the same time with the other hand. In a page-by-page problem chase through the text, few questions are asked for fear of ridicule. The noble fraternity of the mathematical knowing, selects the new initiates from those who find their way through a range of abstraction.

Yes, there are the faculty innovators, but for each one our find, I will show you two or more who refuse to recognize the curriculum impact of the electronic calculator.

Fifteen percent of any class achieves the lesson object at any given time. We learn at individual rates and intensities. The spiral math curriculum design of modern

math texts was an attempt to limit boredom from repetitious drill and offer many entry points to learn key math skill for concepts. The attempt to design a math curriculum to meet individual learning rates was not appreciated by teachers, comfortable with the overkill, massive pages of drill that kept children busy and . . . quiet.

University students are given problem sets from a text written often by their professor in a language reading level of a doctoral student. The text often has an answer key to the odd numbered problems. You know the problems assigned . . . 2, 4, 6.

There are several easy ways to identify factors that interfere with mathematics learning. Poor teaching is at the top of the list. Mathematics teachers, at any level, are scarce. One of eight math teaching positions were filled last year. Math teachers burn out of the profession at a predictable rate from hall duty, massive paper correction, personal attacks, low pay and no respect. They end up in technological careers and as Deans of Student Affairs. They are replaced by coaches, language teachers, and other non-certified teachers, afraid of the next R.I.F. (Reduction in Force); (lay off, being fired?)

Native American Behaviors: Are They Interfering With Achievement?

Native American students try to be invisible in Math class. How can you ask questions when you're not sure why you were admitted to college in the first place? They try to teach themselves from a text that is not designed to instruct. Working with another student would help, but then there is . . . the Honor Code. We value

helping each other. Just one more assimilation conflict. On most campuses it would be a problem set just to find 2 Native Americans taking the same class, at the same time.

Doing Homework Story

Teachers should correct all assignments mathematics students are asked to do. Instant re-enforcement is important in the learning process. You are told this in general instructional techniques (G.I.T.) as a teaching major. You are not told how long it will take. Thirty students per class x six classes a day x five minutes per assignment equals (=) fifteen hours paper correction a day. Each night I had a few more papers uncorrected in my briefcase as I left school. How many days do you think it took before my Volkswagen was filled with uncorrected papers?

Have you ever noticed when the Sewanadw (Anglos) alone . . . in study groups all seem to complete the math problem set with the same answers? Pride! Whom could we trust? We do our own failing.

Why Learn Mathematics? If you know one Native American Mathematician, personally, raise you hand. One person who likes math? Will you use math in your job, career, profession? Is it interesting to study math? Low motivation is another reason for poor achievement.

We are learning more about physioiogical learning dysfunction. The neurological processing of our environment to learn is a serious concern of the mathematics clinicians diagnosing a client's learning difficulty. Number reversals, visual

perception problems, auditory difficulty, are but a few of the sensory malfunctions that prevent some students from learning math. Experts estimate dyslexia and/or dyscalculia affects 3 of 15% of all school children today. Difficulties of sequencing, number reversals and recall difficulties are experiences we all have under stress.

Four Interference Factors to Math Learning

1. Poor or no instruction.
2. Low motivation.
3. Inappropriate learning theory.
4. Physiological learning dysfunction.

What is the Math Clinic?

First, it is a teaching-learning strategy that can be applied to any classroom. What do you want to learn? Do you have the knowledge necessary to learn the new content? (Objectives for learning math, diagnosis of pre-skills.) If the pre-skills are not available, teach to the needed skills. If the pre-skills are mastered, select an appropriate methodology for instruction and apply it to the learning experience. Test to see if you have suceeded in changing the knowledge and/or behavior of the student. Diagnostic teaching skills are practiced here. The lesson objective is not "to teach," it is "to learn."

The Math Clinic is a Place. It requires storage for the tools of math learning, the systems of instruction and the space for clinical teaching. The tools for the Math Clinic include the following suggestions from a much larger list:

a. measuring tools

b. calculators

c. computers

d. reference texts

e. learning kits

f. games

g. individualized instructional systems

h. diagnostic tests

i. video lectures

j. films.

Learning Rate for Math Studies Varies. The diagnostic profile is a chart of the survey test that identifies math achievement abnormalities. Content areas like Geometry, measurement and problem solving are often ignored by the "back to basics" teacher. The profile is a plan for prescriptive teaching. Start with the content that has the poorest record of achievement.

There are many test needs in clinical teaching. Reading level, sensory perception, conservation, and math content can require any of the following test types:

1. Oral: Listen to the student tell you about math.
2. Project Generation: Make a function machine that graphs itself.
3. Model Building: Show commutative law with rods (computers).
4. Written: Computational tests.

A system of instruction is matched to the student from information provided by diagnostic tests. Student choice of learning material and method is a reasonable

way to account for personal learning behaviors. Games are high motivators. Some methods are selected for teaching efficiently. Multiple learning systems in the clinic offer variety or prescriptions for keeping interest high with difficult skills and concepts.

If one approach does not work, there are several other choices to provide new setting for the learning experience. The lesson may be assigned by the teacher, using material from anyone or combination of the following learning systems:

1. An individualized laminated system (like IMS).
2. Computer-video screen instruction.
3. Teacher centered lecture or discovery lessons (small and large groups).
4. Small peer taught lessons (help each other).
5. Individual reading and research.

Review matching the instruction to the student by the clinician requires:

1. Diagnostic test knowledge of achievement.
2. Learning behavior knowledge.

AND 3. Sensory perception data.

A math lab for the university may be one of the immediate solutions available to the technology crisis brought on by the national mathematical intellectual deficit.

The University Math Clinic

Twenty-five (25) years after the "modern math" crisis, brought to our national consciousness by the Russian adventurers in space, we are again full circle to

another national tragedy in the teaching/learning of mathematics

We are becoming an information society served by computers; yet, we have a population of computer illiterates. High school math scores on standardized tests have declined nationwide since 1962. One-half (½) of the students who go to university need remedial writing. Seventy percent (70%) of the students entering college between 1975-1980 were enrolled in remedial math classes. A review of Native American graduate and undergraduate transcripts at Stanford in 1982 revealed thirty-nine (39) no credit grades (F) for seventy (70) students. Nine (9) additional no credit grades in computer science. In a highly selective admissions university, the best Native American students are not successful studying mathematics.

Poor mathematics achievement results in Native American students being tracked into soft sciences and the humanities. They stop out, step out and drop out. The ten (10) year degree completion plan for American Indian students is a common academic history.

A typical university instructional model in mathematics includes:

a. Large lecture classes.

b. Non-english speaking teaching assistants, graduate teachers.

c. Self-taught American Indian students.

AND d. Tutored problem study labs.

Math resource centers in many universities are generally tutoring problem study labs - often staffed by foreign nationals graduate students. (Twenty-two percent

of undergraduate math majors are foreign students; forty percent graduate math students are foreign nationals.)

Students needing mathematics help find the math resource centers crowded, impersonal and unable to go beyond review of a particular problem solving strategy.

I offer to you my university mathematics study model. I would begin with these questions from the entering student.

1. Are you ready for a specific mathematics course?

   A. Have you a record of successful prerequisite math courses, or some evidence of competence, i.e. work experience, personal study, a math clinic diagnostic profile?

   If the students reply suggests enrolling, they would begin a traditional, usually, lecture course. Two other choices would be to enroll in the math clinic to prepare for the course or enroll in the course and the clinic for tutoring support.

2. Are you having difficulty learning in a mathematics class?

   A. Enrolling in a math clinic, the student would have access to the lectures of the enrolled class on video tape, a problem set tutor, and alternate instructional systems, i.e. computer programs, textbooks and kits.

3. Mathematics Anxiety?

   Rx for the "sweaty palms" syndrome would be psychological counseling, hypno-therapy and test taking technique instruction.

4. In some cases, the indicators of physiological dysfunction would be served by the appropriate medical evaluation of senses and brain function. A resulting learning prescription would be written from the current state of medical knowledge.

The student enrolled in a mathematics clinic would see the activity not as "remedial," but, individualized service for personal mathematics achievement. Many Native Americans view "remediation" as a curse on non-academic students. The "hards" and "greasers" take shop and remedial math. The math clinic is but one many paths through mathematics achievement.

The beginning of this path is a survey and diagnostic placement test. It would be used in conjunction with the ACT-SAT math scores for math class or clinic placement.

Individualized instructional systems for the university mathematics clinic would include the following:

a. Video tape lectures for each course in the math catalogue
b. Computer assigned instruction
c. Math text and reference library
d. Games, kits and films
e. Diagnostic teacher-tutors
f. A pre-test, activity, post-test instructional system for the objectives of each math course.

Students enrolled in math clinic would:

a. Prepare a math course

OR b. Complete a math course for credit.

This may create some administrative/faculty problem in grade production credit, but the student could be counted in the mathematics department class roster for F.T.E.

Time in the clinic would vary, as per student need. In most cases, it would be short enrollment to prepare for a course or support the study of a particular semester/quarter. Students finding the instructional systems of a clinic more attractive would complete their mathematics study in that setting.

Completing the Circle

The Native American time frame is notorious for its lack of preciseness. Greater mathematics achievement can take place if our students are not locked to a linear quarter/semester clock hours schedule. Achievement equals rate of learning by time: $A = R \times T$. Rate and time are both variables.

It is important to provide continuous access to mathematics learning over the life of each individual unencumbered by the frustration of failure and repetition.

It is important to give all our people another way to know the universe and have the mathematics skills to survive this time. The mathematics clinic can help provide the way.